IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
[redacted]he Board of Patent Appeals and In[redacted]ces

#AE 3600

In re Patent Application of
TIGHE et al
Serial No. 09/582,760
Filed: June 30, 2000

Atty. Dkt. 540-204
C#/M#
Group Art Unit: 3644
Examiner: G. Barefoot
Date: June 3, 2002

Title: AIRCRAFT STRUCTURE FATIGUE ALLEVIATION

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

☐	**NOTICE OF APPEAL** Applicant hereby appeals to the Board of Appeals from the decision dated _____ of the Examiner twice/finally rejecting claims _____ ($ 320.00)	$	0.00
☒	An appeal **BRIEF** is attached in triplicate in the pending appeal of the above-identified application ($ 320.00)	$	320.00
☐	An **ORAL HEARING** is requested under Rule 194 ($ 280.00) (due within two months after Examiner's Answer)	$	0.00
☐	Credit for fees paid in prior appeal without decision on merits	-$ (	0.00)
☐	A reply brief is attached in triplicate under Rule 193(b)		**(no fee)**
☐	Petition is hereby made to extend the current due date so as to cover the filing date of this paper and attachment(s) **($110.00/1 month**; $400.00/2 months; **$920.00/3 months**; $1440.00/4 months)	$	0.00
	SUBTOTAL	$	320.00
☐	Applicant claims "Small entity" status; enter ½ of subtotal and subtract ☐ "Small entity" statement attached.	-$(	0.00)
	SUBTOTAL	$	320.00
	Less month extension previously paid on	-$(	0.00)
	TOTAL FEE ENCLOSED	$	320.00

Any future submission requiring an extension of time is hereby stated to include a petition for such time extension. The Commissioner is hereby authorized to charge any deficiency, or credit overpayment, in the fee(s) filed, or asserted to be filed, or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our **Account No. 14-1140.** A duplicate copy of this sheet is attached.

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NIXON & VANDERHYE P.C.
By Atty.: Stanley C. Spooner, Reg. No. 27,393

Signature: _____

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of

TIGHE et al Atty. Ref.: **540-204**

Serial No. **09/582,760** Group: **3644**

Filed: **June 30, 2000** Examiner: **Galen Barefood**

For: **AIRCRAFT STRUCTURE FATIGUE ALLEVIATION**

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APPEAL BRIEF

On Appeal From Group Art Unit 3644

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I. REAL PARTY IN INTEREST

The real party in interest in the above-identified appeal is BAE SYSTEMS plc by virtue of the Assignment from the inventors to the assignee recorded June 20, 2000, at Reel 10990, Frame 0491.

II. RELATED APPEALS AND INTERFERENCES

There are believed to be no related appeals or interferences with respect to the present application and appeal.

III. STATUS OF CLAIMS

Claims 1-10 stand rejected in the outstanding Final Rejection. The Examiner contends that claims 1-10 are obvious under 35 USC §103 over the cited prior art.

IV. STATUS OF AMENDMENTS

No further response has been submitted with respect to the Final Official Action in this application.

V. SUMMARY OF THE INVENTION

The present invention relates to methods and structures to alleviate metal fatigue in aircraft, particularly during the various phases of the Ground-Air-Ground (GAG) cycle occurring from take-off to flight to landing in aircraft, especially commercial large commercial aircraft.

During flight, the wings of an aircraft support the weight of the aircraft and bend upwards, while on the ground the wings are supported by the landing gear and fuselage and thus bend downward under their own weight. Repeated take-offs and landings occurring through the GAG cycle provide a cyclic loading to the wings which can shorten their useful life through fatigue of the wing structure.

While it is known to have numerous fuel tanks in the fuselage and wing sections of a large jet aircraft and to transfer fuel amongst these various fuel tanks in order to trim the aircraft for minimum drag at cruise, there is no indication that an automated system could advantageously address the problem.

Appellants found that if at least two fuel tanks are provided, one of which situated in the wing of the aircraft and the other at least somewhat inboard of the wing tank, and an automatic mechanism to transfer fuel between the two tanks, a substantial amount of fatigue alleviation can be obtained. Specifically, when the aircraft is on the ground and the weight of the aircraft supported by the landing gear, fuel is maintained in the inboard tank. However, upon sensing take-off of the aircraft, a fuel management system energizes a pump which transfers fuel from the inboard tank to the outboard wing tank, thereby allowing the wing to directly support the weight of this stored fuel. When the weight of the fuel is carried by the wing, the encountering of gusts and other flight loads on the wing is minimized,

because the wing directly supports the weight of the fuel, rather than stressing the wing spar in the condition when the fuel weight is supported in the fuselage.

The fuel management system also senses when the aircraft is approaching its destination and begins transferring fuel back to the fuselage, such that the impact loads of landing are carried by the fuselage or inboard wing tanks and are supported directly by the landing gear, rather than in the wing outboard fuel tanks (causing excessive wing droop). This automatic reduction in peak loads by the transfer of fuel is not suggested in the prior art and serves to substantially reduce the fatigue loadings of an aircraft.

As noted in appellants' specification, for large long-range aircraft, the reduction in wing structure can result in a weight savings of up to two tons per aircraft. A lighter aircraft means lower fuel consumption per mile traveled and thus significant cost savings can be made both in the manufacturing and operating costs for the aircraft and thus reducing air travel ticket prices.

The present invention is characterized by a fuel transfer apparatus comprising at least two fuel tanks, at least one of which is situated in a wing of an aircraft, a pump for transferring fuel between the tanks and a fuel management system for controlling and monitoring the transfer of fuel. The fuel management system includes a "**means for receiving a first input signal that the aircraft has left the ground**," a "**means for receiving a second input signal that the aircraft**

is approaching its destination," a "**means for initiating the transfer of fuel from a relatively inboard tank location to a relatively outboard tank location in response to the first signal**" and "**means for initiating the transfer of the fuel from a relatively outboard tank location to a relatively inboard tank location in response to the second input signal**."

VI. ISSUES

Whether claims 1-10 are obvious in view of Makhonine (U.S. Patent 2,585,480) in view of Bell (U.S. Patent 5,321,945).

VII. GROUPING OF CLAIMS

The rejected claims do not stand or fall together and are independently patentable as described in the argument portion of this Appeal Brief.

VIII. ARGUMENT

1. Discussion of the References

Makhonine (U.S. Patent 2,585,480) teaches the movement of fuel for reducing the bending stresses acting on aircraft wings during flight. Makhonine teaches the use of inboard and outboard fuel tanks and moving fuel between the two tanks to reduce bending stresses acting on aircraft wings during flight. However, Makhonine contains no disclosure of a fuel management system or any structure for sensing when the aircraft has left the ground and issuing a first input

signal, or for sensing when the aircraft is approaching its destination and issuing a second input signal or any means for transferring fuel from an inboard tank to an outboard tank in response to the first signal and *vice versa* in response to a second input signal.

Moreover, it is noted that at the time of issuing of the Makhonine reference, large commercial 747-type aircraft were not anticipated, nor were the problems of the reduction of gust loads and reducing wing structure and thereby significant weight savings were not considered. In the example shown in the Makhonine reference, a small single engine general aviation-type aircraft is shown, and this certainly does not render obvious the application of the transfer load to alleviate GAG problems in aircraft having a gross weight approaching one million pounds.

Bell (U.S. Patent 5,321,945) teaches various fuel transfer systems applicable to a modern commercial aircraft. However, in the disclosed fuel management system, there appears to be no device for receiving a first signal indicating the aircraft has left the ground or a second signal that the aircraft is approaching its destination. While there are various fuel pumps anticipated in the Bell device, there does not appear to be any pumps which are responsive to the above-described first or second input signals. Thus, Bell fails to disclose any of the operative features of the present invention.

2. Discussion of the Rejection

Claims 1-10 stand rejected under 35 USC §103 as unpatentable over Makhonine in view of Bell. To the extent the rejection is understood, the Examiner appears to believe that Makhonine's teaching of the basic concept of transferring fuel between inboard and outboard tanks to reduce wing stress and that Bell teaches automatic fuel transfer systems. the Examiner apparently believes that these two references render it obvious for one to somehow automate the "fuel balancing system of Makhonine automatic as taught in general by Bell."

3. The Errors in the Final Rejection

There are at least three significant errors in the Final Rejection and they are summarized as follows:

(a) There is no prior art teaching of a means for receiving the first or second input signals;

(b) There is no prior art teaching of any fuel transfer means which is responsive to either the first or second input signals; and

(c) The Examiner fails to provide any reason or motivation apparent from the record for combining the Makhonine and Bell references.

(a) There is no prior art teaching of a means for receiving the first or second input signals

Appellants' apparatus claims 1 and 10 and method claim 9 all recite "means for receiving a first input signal that the aircraft has left the ground" and "means for receiving a second input signal that the aircraft is approaching its destination." (method claim 9 recites this in method form). Each of these elements in independent apparatus claims 1 and 10 are in "means-plus-function" format and method claim 9 is in "step-plus-function" form, requiring, under the *In re Donaldson* line of cases from the Court of Appeals for the Federal Circuit, the Examiner to look to the corresponding structure in appellants' specification.

The specification on page 6 indicates that on take-off "a signal is sent to the fuel management system." This signal corresponds to the first input signal to which the fuel management system is responsive indicating the aircraft has left the ground. Thus, the prior art must disclose such a signal or equivalents thereof in order for this structure to be shown in a prior art reference. This structure is clearly missing in both the Makhonine and Bell references.

On specification page 6, third full paragraph, it is stated that "as the aircraft approaches its destination and begins its descent towards the landing field, a signal is sent to the fuel management system which initiates a re-transfer of the remaining fuel." Again., there appears to be no disclosure in Makhonine or in Bell of the transmission of a signal indicating the aircraft is approaching its destination.

"The PTO has the burden under §103 to establish a *prima facie* case of obviousness." *In re Fine*, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). The Court of Appeals for the Federal Circuit has clarified that the PTO "can satisfy this burden only by showing some objective teaching in the prior art. . . ." *Id.* In the present instance, the Examiner has not alleged that either Makhonine or Bell contains any teaching of the provision of the claimed first and second input signals. Without any teaching of claimed structure in either of the two cited references, there can be no teaching of the combination of the two references. As a result, the rejection under §103 clearly fails.

(b) There is no prior art teaching of any fuel transfer means which is responsive to either the first or second input signals

Appellants' claim specifies a fuel management system which includes a "means for initiating the transfer of fuel" between inboard and outboard tanks in response to the first or the second input signal. As noted above, neither Makhonine nor Bell contain any disclosure of a fuel management system which is responsive to the first and second input signals and, therefore, fail to show this claimed structure.

Because the claimed structure is not present in either of the cited prior art references, it cannot be present in the combination of the cited prior art references. As a result, the rejection under 35 USC §103 fails for this second reason.

(c) The Examiner fails to provide any reason or motivation apparent from the record for combining the Makhonine and Bell references

As appellants noted on page 8 of the previously filed Amendment (filed October 9, 2001),

> "to prevent the use of hindsight based on the invention to defeat patentability of the invention, **this court requires** the examiner to show a motivation to combine the references that create the case obviousness. In other words, **the examiner must show reasons** that the skilled artisan, confronted with the same problems as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination in the manner claimed." (Emphasis added).

In re Rouffet, 47 USPQ2d 1453, 1458 (Fed. Cir. 1998). As noted above, there is no recognition of the fatigue problem solved by the present invention in either the Makhonine or Bell references, and therefore, there is no indication as to why one of ordinary skill in the art would even consult either of these references when attempting to solve the fatigue problem which is addressed in the present application.

The prior art is characterized by a singular lack of recognition of the problem of GAG caused stress or that an automated system could easily and efficiently resolve or reduce such stress. Where does any prior art reference suggest that there be two signals or that the fuel management system be responsive to the two signals. While the Examiner may suggest that, in view of the prior art it

might be obvious to try the claimed combination, "obvious to try" is not the test of patentability under 35 USC §103.

Because there is no motivation to combine the Makhonine and Bell references, even if they disclosed the various claimed components of appellants' invention (and this contention is respectfully traversed), they do not render the claimed invention obvious in view thereof.

The above points are clearly true with respect to appellants' independent apparatus claims 1 and 10. Also, with respect to claim 9, the Examiner has not indicated any basis for appellants' claimed method steps, i.e. the first and second providing steps or the first and second initiating steps.

Appellants' claim 2 specifies that the fuel management system is a computerized system and utilizes a computer algorithm responding to the various input signals and sequence of fuel transfers. The Examiner has not indicate how or where any computerized fuel management system is shown in any prior art reference.

Claim 3 specifies that the fuel management computer algorithm is specific to the preprogrammed flight path of the aircraft. There is no disclosure of such a computer algorithm in the Makhonine and Bell references.

Claim 4 further limits claim 1 by indicating that the fuel management system is programmed to respond to a first signal and when the gear wheels have

left the ground. There is no indication of any such structure or program in response to the first input signal discussed in either the Makhonine or Bell references.

Claim 5, also dependent on claim 1, specifies that the fuel management system is programmed to respond to a second input signal indicating that the aircraft has descended to a certain altitude on its approach to landing. Again, there is no recognition of the problem and thus no indication of appellants' solution to the problem contained in the Makhonine and Bell references.

Claim 6 limits claim 1 by indicating that the second input signal is relayed between a flight control program and a fuel management system when a certain point on the pre-programmed flight path has been reached. Again, neither Makhonine nor Bell disclose any pre-programmed flight path, nor do they disclose initiating a transfer when a pre-programmed point on the flight path is reached.

Claim 7 specifies that the fuel management system has a manual override allowing the flight crew to adapt to unforeseen circumstances. Again, because neither Makhonine nor Bell contain any such automated or pre-programmed fuel transfer system, they do not include a manual override facility as required by claim 7.

Claim 8 recites an aircraft including a fuel transfer apparatus as discussed in claim 1. Neither Makhonine nor Bell teach an aircraft which has a fuel transfer system as set out in appellants' claim 1.

As a result, independent claims 1, 9 and 10 and claims 2-8 dependent on claim 1 are all clearly patentable over the Makhonine/Bell combination of references and any further rejection thereunder is respectfully traversed.

IX. CONCLUSION

Appellants have noted four elements or method steps recited in appellants' independent claims which are simply not present in either of the cited prior art references. The fact that one could modify the prior art references to operate in a manner similar to appellants' claimed invention does not render obvious the claimed invention. There must be some positive teaching or reason or motivation for one of ordinary skill in the art to combine the elements of the prior art. But of course, before such combination can take place, the elements themselves must be disclosed in the prior art. Both the elements and the motivation to combine are missing in the prior art cited by the Examiner, thereby failing to establish a *prima facie* case of obviousness under 35 USC §103. As a result, there is simply no basis for the allegation that appellants' claimed invention is unpatentable over the prior art references.

Thus, and in view of the above, the rejection of claims 1-10 over the cited prior art is clearly in error and reversal thereof by this Honorable Board is respectfully requested.

Respectfully submitted,

NIXON & VANDERHYE P.C.

By: _____

Stanley C. Spooner
Reg. No. 27,393

SCS:kmm
Enclosures
Appendix A – Claims on Appeal

APPENDIX A

Claims on Appeal

1. A fuel transfer apparatus for an aircraft comprising:

at least two fuel tanks arranged in an inboard to outboard alignment, at least one tank being situated in a wing of the aircraft,

at least one pump for transferring fuel between the tanks, and

a fuel management system for controlling and monitoring the transfer of fuel between tanks, said system comprising:

means for receiving a first input signal that the aircraft has left the ground;

means for receiving a second input signal that the aircraft is approaching its destination,

means for initiating the transfer of the fuel from a relatively inboard tank location to a relatively outboard tank location in response to the first input signal, and

means for initiating the transfer of the fuel from a relatively outboard tank location to a relatively inboard tank location in response to the second input signal.

2. A fuel transfer apparatus as claimed in claim 1 wherein the fuel management system is computerised and comprises a computer algorithm designed to respond to the various input signals and initiate the fuel transfer in the desired sequence.

3. A fuel transfer apparatus as claimed in claim 2 wherein the computer algorithm is specific to a pre-programmed flight path for the aircraft.

4. A fuel transfer apparatus as claimed in claim 1 wherein the fuel management system is programmed to respond to a first signal sent to the flight control system of the aircraft when the gear wheels have left the ground.

5. A fuel transfer apparatus as claimed in claim 1 wherein the fuel management system is programmed to respond to a second input signal that the aircraft has descended to a certain altitude on its approach to land.

6. A fuel transfer apparatus as claimed in claim 1 wherein said second input signal is relayed between the flight control program and the fuel management system when a certain point on a pre-programmed flight path has been reached.

7. A fuel transfer apparatus as claimed in claim 1 wherein the fuel management system will have manual override facility to enable flight crew to adapt to unforeseen circumstances.

8. An aircraft comprising a fuel transfer apparatus as claimed in claim 1.

9. A method of fuel transfer for an aircraft including at least two fuel tanks arranged in an inboard to outboard alignment with respect to a centerline of the aircraft, at least one outboard tank being situated in a wing of the aircraft, at least one pump for transferring fuel between the tanks, and a fuel management system for controlling and monitoring the transfer of fuel between tanks, said method comprising the steps of:

providing a first input signal, indicating that the aircraft has left the ground;

initiating the transfer of the fuel from a relatively inboard tank location to a relatively outboard tank location in response to the first input signal,

providing a second input signal that the aircraft is approaching a destination; and

initiating the transfer of the fuel from said at least one outboard tank to said inboard tank in response to the second input signal.

10. A fuel transfer apparatus for an aircraft having at least one inboard fuel tank and at least one outboard fuel tank, said at least one outboard tank being situated in a wing of the aircraft, at least one pump for transferring fuel between the tanks, and a fuel management system for controlling and monitoring the transfer of fuel between tanks, said system comprising:

means for initiating the pump transfer of the fuel from said at least one inboard tank to said at least one outboard tank in response to a first input signal that the aircraft has left the ground; and

means for initiating the transfer of the fuel from said at least one outboard tank to said at least one inboard tank in response to a second input signal that said aircraft is approaching a destination.